

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
 United States Patent and Trademark
 Office
 Box PCT
 Washington, D.C. 20231
 ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 29 September 2000 (29.09.00)	
International application No. PCT/GB00/00268	Applicant's or agent's file reference 297
International filing date (day/month/year) 31 January 2000 (31.01.00)	Priority date (day/month/year) 01 February 1999 (01.02.99)
Applicant KATHIRGAMANATHAN, Poopathy	

1. The designated Office is hereby notified of its election made:



in the demand filed with the International Preliminary Examining Authority on:

30 August 2000 (30.08.00)



in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740 14 35	Authorized officer Juan Cruz Telephone No.: (41-22) 338.83.38
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PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 297	FOR FURTHER ACTION <small>see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.</small>	
International application No. PCT/GB 00/ 00268	International filing date (day/month/year) 31/01/2000	(Earliest) Priority Date (day/month/year) 01/02/1999
Applicant SOUTH BANK UNIVERSITY ENTERPRISES LTD et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of Invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention

☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

P GB 00/00268

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C09K11/06 H05B33/14 C07C229/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C09K H05B C07C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

CHEM ABS Data, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	TEMPLETON, LIESELOTTE K. ET AL: "Anomalous scattering by praseodymium, samarium and gadolinium and structures of their ethylenediaminetetraacetate (edta) salts" ACTA CRYSTALLOGR., SECT. B (1982), B38(8), 2155-9, ✓ XP002139485 table 1 ----	1-5
X	WO 98 55561 A (CHRISTOU VICTOR ;ISIS ✓ INNOVATION (GB)) 10 December 1998 (1998-12-10) cited in the application page 7, paragraph 5; claims 1,3,4; examples 9,16 ----- -/--	1,2, 10-24

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

13 July 2000

Date of mailing of the international search report

25/07/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Shade, M

INTERNATIONAL SEARCH REPORT

International Application No

P GB 00/00268

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	✓ ARMAROLI N ET AL: "Luminescence properties of Eu, Tb, and Gd complexes of the hexadentate N-donor podand tris-3-(2-pyridyl)pyrazol-1-ylhydroborate" CHEMICAL PHYSICS LETTERS, NL, AMSTERDAM, vol. 5-6, no. 276, 29 September 1997 (1997-09-29), pages 435-440, XP002074915 figures 1,3 ---	1,2
A	✓ WO 98 58037 A (KATHIRGAMANATHAN POOPATHY ; SOUTH BANK UNIV ENTPR LTD (GB)) 23 December 1998 (1998-12-23) cited in the application claims 1-29 ---	10-24
A	✓ "ULTRAVIOLET ELECTROLUMINESCENCE FROM AN ORGANIC LIGHT EMITTING DIODE" ADVANCED MATERIALS, DE, VCH VERLAGSGESELLSCHAFT, WEINHEIM, vol. 7, no. 11, 1 November 1995 (1995-11-01), pages 900-903, XP000537408 ISSN: 0935-9648 the whole document -----	10-24

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

GB 00/00268

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
W0 9855561	A	10-12-1998	AU	7668198 A	21-12-1998
			EP	0988353 A	29-03-2000

W0 9858037	A	23-12-1998	AU	8116598 A	04-01-1999
			EP	0990016 A	05-04-2000

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL PRELIMINARY
EXAMINATION REPORT

(PCT Rule 71.1)

To:

COHEN, Alan Nicol
2 Grove Place
Tatsfield near Westerham
Kent TN16 2BB
GRANDE BRETAGNE

Date of mailing
(day/month/year) 24.04.2001

Applicant's or agent's file reference 297		IMPORTANT NOTIFICATION	
International application No. PCT/GB00/00268	International filing date (day/month/year) 31/01/2000	Priority date (day/month/year) 01/02/1999	
Applicant SOUTH BANK UNIVERSITY ENTERPRISES LTD et al.			



1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/  European Patent Office - P.B. 5618 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized officer Sinanovic, E Tel. +31 70 340-2672	
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FILED 26 APR 2001

WIPO PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

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Applicant's or agent's file reference 297	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB00/00268	International filing date (day/month/year) 31/01/2000	Priority date (day/month/year) 01/02/1999
International Patent Classification (IPC) or national classification and IPC C09K11/00		
Applicant SOUTH BANK UNIVERSITY ENTERPRISES LTD et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 8 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 30/08/2000	Date of completion of this report 24.04.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized officer Shade, M Telephone No. +31 70 340 2332 

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB00/00268

I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).)*:

Description, pages:

1-7 as originally filed

Claims, No.:

1-24 as originally filed

Drawings, sheets:

1/2-2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/00268

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	6-24
	No:	Claims	1-5
Inventive step (IS)	Yes:	Claims	6-9
	No:	Claims	1-5, 10-24
Industrial applicability (IA)	Yes:	Claims	1-24
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

1) Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1.1) Reference is made to the following documents:

- D1: Acta Crystallogr., Sect. B (1982), B38(8), 2155-9
- D2: WO-A-9855561
- D3: WO-A-9858037
- D4: Chemical Physics Letters, nl, amsterdam (0000), 5-6(276), 435-440
- D5: Advanced Materials, de, vch Verlagsgesellschaft, Weinheim (01-11-1995), 7(11), 900-903

1.2) Document D1 discloses the compound Na[Gd(edta)] see Table 1, page 2156. Therefore the subject-matter of present claims 1 to 5 is not novel and does not satisfy the criteria of Article 33(1) and (2) PCT.

1.3) Document D2 discloses two gadolinium(III) complexes with polyamine ligands which emit light in the UV region, see examples 9 and 16 and page 7, paragraph 5, where it is stated that complexes of gadolinium provide UV radiation. Therefore the subject-matter of present claims 1 and 2 is not novel and does not satisfy the criteria of Article 33(1) and (2) PCT.

1.4) Document D4 discloses a gadolinium(III) complex of a pyrazolylborate polyamine ligand which emits light in the range 400nm to 500nm with a prominent peak at 450nm, see D4, Figure 1 and Figure 3. A comparison of this emission with that of Gd[Eu(etda)]₃ which as shown in Figure 2 of the present application emits over a range of 400nm to 500nm leads to the conclusion that if the latter compound emits light in the UV region then so must the former compound of the prior art. Therefore the subject-matter of present claims 1 and 2 is not novel over document D4 and so does not satisfy the criteria of Article 33(1) and (2) PCT. See also paragraph 3.2 below regarding the clarity of present claim 1.

1.5) The subject-matter of present claims 10-24 does not involve an inventive step over the closest prior art document D2, therefore the the subject-matter of claims

10-24 does not satisfy the criteria of Article 33(1) and (3) PCT. Document D2 discloses a light emitting device comprising a transparent indium-tin oxide anode, an emitting layer comprising hole-transporting polyvinylcarbazole, electron-transporting 2-(4-biphenyl)-5-(5-tertbutylbenzene)-1,3,4-oxadiazole and an electroluminescent complex of a lanthanide metal, in this case terbium, and a polyamine ligand and a magnesium cathode, see D2, example 2, page 16. The difference between the subject-matter of present claims 10-24 and that disclosed in D2 is that in present claim 10 the electroluminescent material emits light in the ultra-violet region of the spectrum. The problem associated with this difference is to provide an electroluminescent device emitting ultra-violet light. This problem is also outlined by the present applicant on page 2, first paragraph of the present description. When faced with this problem the person skilled in the art would be prompted by the disclosure on page 7, paragraph 5 of D2 to use a gadolinium(III) polyamine complex as the electroluminescent material as such complexes are known to emit UV light. The person skilled in the art would then arrive at an electroluminescent device corresponding to the subject-matter of present claims 10-24.

- 1.6) The additional technical features of claims 12, 17, 23 and 24 are either well known in the art or fall within the knowledge and ability of the skilled person. Thus their inclusion in an electroluminescent device is considered obvious. With reference to the subject-matter of claim 12, see D3, claim 11, with reference to the subject-matter of claim 17, see D3, claim 16 and with reference to the subject-matter of claim 23, see D3, claim 25.
- 1.7) The subject-matter of present claims 6 to 9 satisfy the criteria of Article 33(1) (2) and (3) PCT regarding novelty and inventive step as their subject-matter, a material comprising a complex of a transition metal, lanthanide or actinide and the ligand edta, dcta, dtpa or ttha in which the complex is in the form of a transition metal, lanthanide or actinide salt is not disclosed in or made obvious by the prior art.
- 1.8) The subject-matter of present claims 1 to 24 satisfies the criteria of Article 33(4), the electroluminescent material and devices having industrial application in the field of light emitting devices.

2) Re Item VII

Certain defects in the international application

- 2.1) Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1, D4 and D5 is not mentioned in the description, nor are these documents identified therein.

3) Re Item VIII

Certain observations on the international application

- 3.1) Present claim 1 is directed to complexes of transition metals, lanthanides or actinides and polyamine ligands, the description provides only two examples of such complexes, both being lanthanides. Clearly, contrary to Article 6 PCT, the description does not fully support a claim of such broad scope as present claim 1. Related to this point is the question as to whether the description, which provides only two examples of electroluminescent materials, both within a very limited range of those claimed, and further provides no examples of electroluminescent devices, can be considered to disclose the invention in a manner sufficiently clear and complete for the claimed invention to be carried out by a person skilled in the art, as is required by Article 5 PCT.
- 3.2) Ultraviolet light is defined as being light of a wavelength below 400nm, see for example D5, page 901, column 1, paragraph 2. As can be seen in Figure 2 of the present application the compound $\text{Gd}[\text{Eu}(\text{etda})]_3$ emits light principally outside this range, i.e. its most intense emission falls between 400nm and 500nm, therefore the compound $\text{Gd}[\text{Eu}(\text{etda})]_3$ of example 2 is not an embodiment according to the present claims. This inconsistency between the claims and the description leads to doubt concerning the matter for which protection is sought, thereby rendering the claims unclear (Article 6 PCT).
- 3.3) The subject matter of claim 7 is not clear since the claim describes a salt $\text{Ln}[\text{Ln}(\text{edta})]_3$ in which Ln is stated to be a transition metal, lanthanide or actinide. The term Ln is generally accepted to refer only to lanthanides and the suggestion that it may refer to some other group of elements renders the claim unclear, contrary to Article 6 PCT. The same statement occurs on page 3, line 13 of the

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EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB00/00268

description. It is also noted that such a use of the term Ln is contrary to Rule 10.1(e) PCT.

- 3.4) In claim 3 and on page 2, line 23 ethylenediamine tetraacetic acid (edta) is incorrectly referred to as ethylene diamine tetramine, this leads to a lack of clarity of the claims contrary to Article 6 PCT.
- 3.5) In claims 16, 21 and 22 and on page 6, line 2 what is clearly the cathode is incorrectly referred to as the anode, leading to a lack of clarity of the claims contrary to Article 6 PCT.
- 3.6) The dependency of a number of the claims gives rise to a lack of clarity of the claims as a whole contrary to Article 6 PCT, the claims are as follows;
- 3.7.1) Claim 9 indicates that it is dependent on claim 5 although the subject-matter of claim 9 is a gadolinium salt and claim 5 is restricted to only alkali metal salts.
- 3.7.2) Claim 11 indicates that in addition to being dependent on claim 10 it is also dependent on claims 1 to 9 this renders the subject-matter of the claims unclear since dependent claim 11 is directed to an electroluminescent device whereas claims 1 to 9 are for an electroluminescent material.
- 3.8) The term "aromatic amine complex" in claim 14 is not clear since it is obvious from the description, page 5, lines 7 to 9, and from dependent claim 15 that the compounds referred to are aromatic amines and not complexes of aromatic amines.
- 3.9) Claims 19 and 20 are directed to electroluminescent devices comprising oxadiazoles, contrary to Article 5 PCT there is no support in the description for such devices since there is no mention in the description of oxadiazoles.
- 3.10) In order to expediate the procedure a number of other errors, typographical mistakes etc which occur in the description are indicated below:
- 3.10.1) On page 1, lines 15 and 17, the year 1990 is incorrectly written as 1990 i.e. using

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I rather than 1.

3.10.2) On page 3 the structure of DCTA is incorrect, lacking a CH₂ group adjacent to a nitrogen.

3.10.3) On page 4, line 9, the letter s has been omitted from the word includes.

3.10.4) On page 4, line 28, there is an incorrectly placed semicolon.

3.10.5) On page 5, line 8, the letters I, I' have been used in the formula where the numbers 1, 1' should be used.

3.10.7) On page 7, line 4, the brackets which are opened are not closed.